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# The Received View and Its Images

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**Abstract**

The Received View on scientific theories is a framework for formalizing and analyzing theories mainly developed by Rudolf Carnap and Carl Gustav Hempel within logical empiricism. Its central assumptions are that theories and observations can be formalized in predicate logic, that the language of formalization has a context-dependent observational sub-language or separate observation language, and that the interpretation of the language is restricted only by theories and the interpretation of the observational language. For the observational language as a sub-language, non-observational terms were initially assumed to be explicitly definable in observational terms, and later assumed to have necessary or sufficient conditions in observational terms. In the final version of the Received View, no specific relations between observational terms and theoretical terms were assumed. The Received View also provided the framework for conceptualizations of explanation, confirmation, reduction, criteria of cognitive significance, the analytic-synthetic distinction, and concept formation. Many criticisms of the Received View in the philosophy of science rely on misrepresentations.

**Biography**

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## The Three Components of the Received View and Its Position in Logical Empiricism

The Received View is the earliest general framework in the philosophy of science for the formalization of scientific theories and their relations to empirical results. Importantly,

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it is meant to be used for the rational reconstruction of theories in the context of justification (Feigl 1970, 4), not their origination in the context of discovery (Feigl 1970, 13–14; Hempel 1970, 148). Relatedly, the reconstruction of a theory in the Received View was not meant to describe the theory's development over time, but rather a momentary stage in its development (Hempel 1969, 54; Przełęcki 1969, 105–6).

The Received View has three central components, which will be referred to by slightly a-historical names in the following: That theories, observations, and their relation are to be formalized in predicate logic will be called the *syntactic view*. That the language of science has a distinct observational part will be called the *dual-level conception* of scientific language (following Stegmüller 1976, §I.1). That the interpretation of scientific theories proceeds from this observational part will be called *semantic empiricism* (following Rozeboom 1962, 303).

The Received View was primarily developed by Rudolf Carnap and in earlier works of Carl Gustav Hempel, but it was isolated as a view on theories by others, who baptized it the 'received view', 'syntactic approach', 'orthodox view', 'standard conception', or 'syntactic view' to criticize or defend it (Lutz 2012, 78). The name 'Received View', as well as the received view on the Received View, was canonized by Suppe (1974a, §§I–II), who based his description of the "Received View as initially presented by the Vienna Circle" (16) on articles by Carnap, and his description of "the final version of the Received View" (§II.E, n. 107) on articles by Carnap and Hempel. Suppe (2000, S102) later declared the Received View "the epistemic heart of logical positivism", but as Mormann (2007) lays out, there were a number of competitors to the Received View within logical empiricism: Otto Neurath insisted in his "encyclopedism" that much of science cannot be axiomatized at all, rejecting the syntactic view; Hempel disavowed in later works that the meanings of a theory's terms have to derive from observations, rejecting semantic empiricism; Hans Reichenbach focused on probability rather than predicate logic.

## The Syntactic View

Even though the Received View as a whole is sometimes called the 'syntactic view', its reliance on predicate logic is in a sense its most accidental component: Carnap had encountered the logic of Frege and of Russell and Whitehead (Carnap 1963a, 11), and he used this formal tool for the problem at hand, but according to his Principle of

Tolerance (Carnap 1934, §17), any other sufficiently precise formalism could have been used. Be this as it may, Carnap and Hempel typically assume higher order predicate logic (Lutz 2012, §2), with Carnap (1956, 51, 62) allowing for both syntactic deduction and semantic entailment. For some, higher order logic is effectively already set theory, and set theory can be axiomatized in predicate logic anyway, so it is possible to use all of set theory in the Received View. Carnap (1961) later also uses Hilbert's $\varepsilon$ operator and allows for modal logic (Carnap 1956, §III) and probability theory (47, 49, 52, 68).

Adding to this flexibility is that the Received View does not require that theories be exhaustively axiomatized (Lutz 2012, §3). It just has to be *in principle* possible to provide an axiomatization of those statements that are required for the inference at hand (Carnap 1939, §15). This allows, for instance, the use of naive set theory (Feigl 1970, 8; Hempel 1970, §3) and of mathematics (Hempel 1970, §3).

For the axiomatization of specific theories of physics, Carnap mostly assumes field theories (Lutz 2021, §15.4.1), but also, for instance in the formalization of the topology of space-time, set theory previously axiomatized in higher order logic (Carnap 1929, §§A-C).

## The Dual-Level Conception of Language

The Received View distinguishes between observational language and non-observational ("theoretical") language (and not primarily between observable and unobservable objects; see also the next section). Both the logical structure of the observational language and what this language describes depend on the context of the analysis. Regarding the latter, Carnap (1932, 465–66) states that one can choose the observation sentences depending on the context, and that one can treat sentences accepted as observational in one context as theoretical in another (see also Przełęcki 1969, ch. 10; Mormann 2007, 146). Accordingly, the observation sentences (sometimes called 'protocol sentences') may for instance describe the simplest experiences, partial gestalts of single senses, entire sensory fields, the total experience during an instant, or material things (Carnap 1931, §3). In one publication, Carnap (1939, §24) drops the terminology of observational and theoretical terms completely in favor of "elementary" and "abstract" terms. Reichenbach (1951, 49) suggests calling observational terms '*direct terms*', which have "*direct meaning* [...], i.e., a meaning which is not under investigation during the analysis to be performed." Importantly, the observational terms do not have to be those of ordinary

language (Carnap 1928a, §67; 1932, 459–61), and observation protocols in the sciences usually do not contain only sentences "directly obtained", but rather include sentences that are already inferred (Carnap 1931, 437–38). But even the terms referring specifically to physiological perception can differ from person to person, since what one person can perceive may be imperceptible for another (Carnap 1936a, §16).

The logical structure of the observational language and its relation to the theoretical language is initially described informally (e.g., Carnap 1923, 1926). Soon, however, Carnap (1928a) assumes a single language with an observational sub-language and thereafter discusses the sub-language approach as an alternative to treating observational and theoretical languages as separate (Carnap 1932).[2]

In all subsequent publications developing the Received View, the observational language is treated as a sub-language, so that it becomes important which forms its expressions can take. In keeping with the tolerance towards what counts as observation, Carnap (1956, §II) allows for different requirements for the observational sub-language, for instance that all primitive descriptive terms are observational, that values of variables must be concrete, observable entities, and that the language contains only truth-functional connectives. Later, Hempel (1958, 64–66) and, more extensively, Carnap (1963b, 24A) use a "logically extended observation language", which has no restrictions besides the restriction to observational terms and truth-functional connectives, and is therefore a standard language of higher order logic in which all non-logical constants are observational terms.

## Semantic Empiricism

Trivially, a string of symbols means nothing if it is uninterpreted, and even sentences do not state anything about the world without an interpretation. This point is made by Schlick (1918, §10), who calls an interpretation a 'coordination' ("Zuordnung"). With reference to Schlick, Reichenbach (1928, §4) states that such coordinations should be systematic and proceed by "coordinative definitions" ("Zuordnungsdefinitionen"), which he distinguishes explicitly from syntactic definitions (Padovani 2015, §2). He also, at least in his examples, restricts the referents of physical terms to experimentally accessible objects and events. Carnap (1974, ch. 24) treats the account of Reichenbach,

[2] Surprisingly, Carnap (1932, 215) credits Neurath (1932) with the sub-language approach.

together with the more syntactic accounts of N. R. Campbell and P. W. Bridgman, as akin to the correspondence rules of the Received View.

The probably best-known diagram of the role of correspondence rules in the interpretation of theories (figure 1) is given by Feigl (1970, 6). Unfortunately, the diagram is also somewhat misleading. According to Feigl (1970, 5–6), the primitive theoretical terms are interrelated through the postulates of the theory and used to define other concepts. These are then linked by correspondence rules to concepts that refer to "items of observation" like mass and temperature, which are in turn "operationally defined", i.e., by specifying rules of measurement, statistical design, etc. In Feigl's diagram, the operational definitions could seem to be semantic interpretations, but as his description makes clear, they embody non-interpretative elements like statistical design.

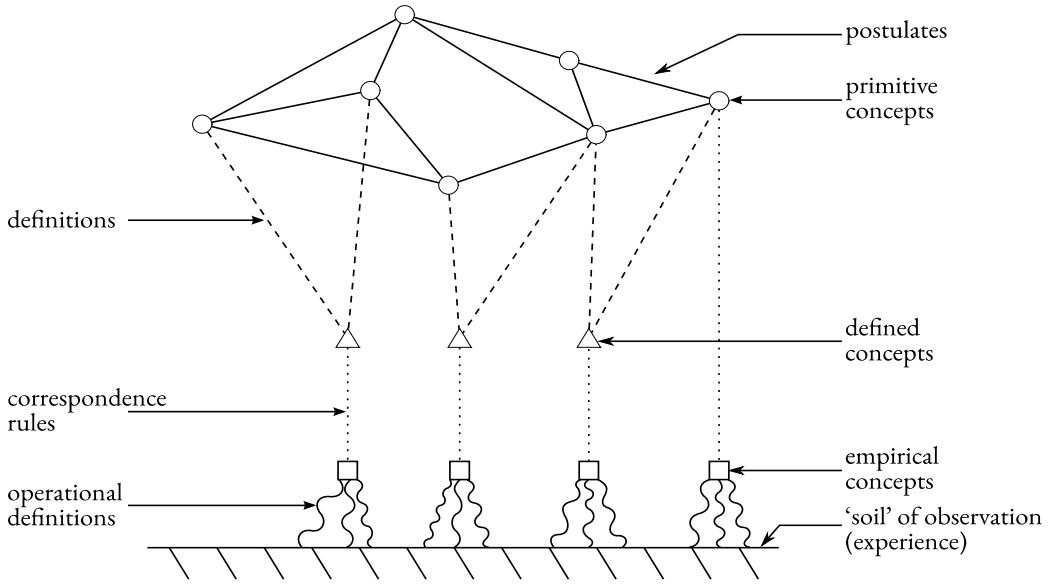


**Figure 1:** The relation of theoretical and observational terms according to Feigl (1970, 6). Feigl's figure differs from the one here in that it does not include the labels on the left side and uses dashed lines both for definitions and correspondences rules.

A more straightforward account can be gleaned from a diagram by Carnap (1939, 205). From the early 1930s on Carnap had made a clear distinction between syntax and semantics (Reck 2007, 189–191) and between object language and metalanguage (Carnap 1934). After implicitly relying on semantic concepts even in a notionally syntactic metalanguage of science (Leitgeb and Carus 2021, §5.1), Carnap (1936b) soon fully embraced semantics as a part of the logic of science. This shows in the diagram

(figure 2), in which the observational terms are directly semantically interpreted, while the interpretation of the theoretical terms derives from that of the observational terms and sentences in the object language.

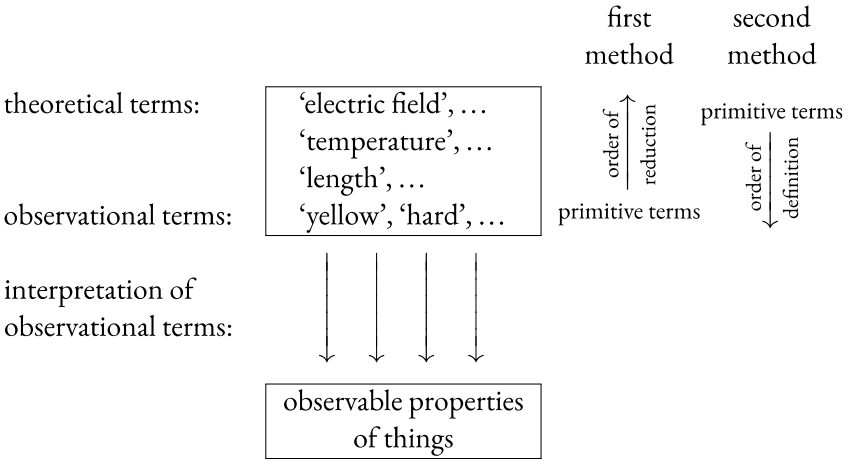


**Figure 2:** Carnap's two methods of giving an empirical interpretation to theoretical terms (adapted from Carnap 1939, 205, where 'elementary' and 'abstract' are used instead of 'observational' and 'theoretical', and 'definition' instead of 'reduction' in the first method.).

In his discussions of scientific theories, Carnap tends to leave the description of the semantics informal, but when he does specify it formally, he uses a set-theoretical metalanguage for describing Tarski semantics (Carnap 1956, 43). Carnap never explicitly develops the formal semantics for theoretical terms within semantic empiricism. Instead, this is done by Suppe (1971, §II) and, much more clearly and thoroughly, by Przełęcki (1969). The core idea in the approach is to initially use a structure in the sense of Tarski semantics for the interpretation of the observational terms, and interpret the theoretical terms by the class of structures whose interpretation of the observational terms is identical to that of the initial structure, and which are models of the sentences in the object language that provide the interpretation of the theoretical terms. This approach also provides a "partial interpretation" (Hempel 1950, 57; 1952, 690, 694–95, 724–25) of theoretical terms when they are not explicitly defined in observational terms. A precursor to this semantics is given by Carnap (1927, 372) himself who informally describes the interpretation of "improper concepts" as partially restricted by "proper concepts" (i.e., completely interpreted terms).

The sentences that provide the interpretation of the theoretical terms may be

postulates of the theory under investigation, or they may derive from other theories (Carnap 1923, 103; 1928a, §106). In the latter case, the sentences are called 'correspondence rules'. Whether a sentence is a correspondence rule is thus relative to the theory under investigation. In this respect, correspondence rules are to interpretation what auxiliary assumptions (Hempel 1945, 102, n. 1; Hempel 1966, §3.2) are to confirmation. For specific reconstructions of theories and accounts of interpretation and confirmation, all and only auxiliary assumptions may be correspondence rules.

One important question in the Received View was what kind of correspondence rules can be derived from empirical theories. Looking back, Hempel (1952, §§6–7) and Carnap (1963a, §9) describe the development of the Received View on correspondence rules as a gradual liberalization. Initially, every term is to be explicitly definable in observational terms (Carnap 1928a, §35). But Carnap (1936a, §7–8) relaxes this claim after he has come to the opinion that it is impossible to define disposition terms explicitly in non-dispositional observational terms. Instead, he suggests that new terms should be introduced by reduction pairs, that is, necessary conditions and (typically different) sufficient conditions. This is the "first method" in Carnap's diagram (figure 2). In an adaptation of Feigl's diagram to this method (figure 3), the observational terms are semantically interpreted, and formulas of observational terms are used in reduction pairs for more theoretical terms, which are thereby partially interpreted and can be in turn used in reduction pairs for even more theoretical terms.

Later, Carnap (1939, 205) introduces the "second method" of relating observational and theoretical terms given in his diagram. This method starts from the theoretical terms and connects these to successively more observational ones (see also Hempel 1952, 684). Carnap (1939, 206) notes that in this method it might be in principle possible to rely on explicit definitions, although so far most of the more observational terms still have to be taken as primitive. In an adaptation of Feigl's diagram to this second method (figure 4), the observational terms are again semantically interpreted, but it is formulas of theoretical terms which provide definientia for less theoretical terms, which can then again be used in definientia of even less theoretical terms, until the observational terms are defined. Note that both for definitions (of theoretical and of observational terms) and reduction pairs, theoretical and observational terms sometimes apply to the same objects.

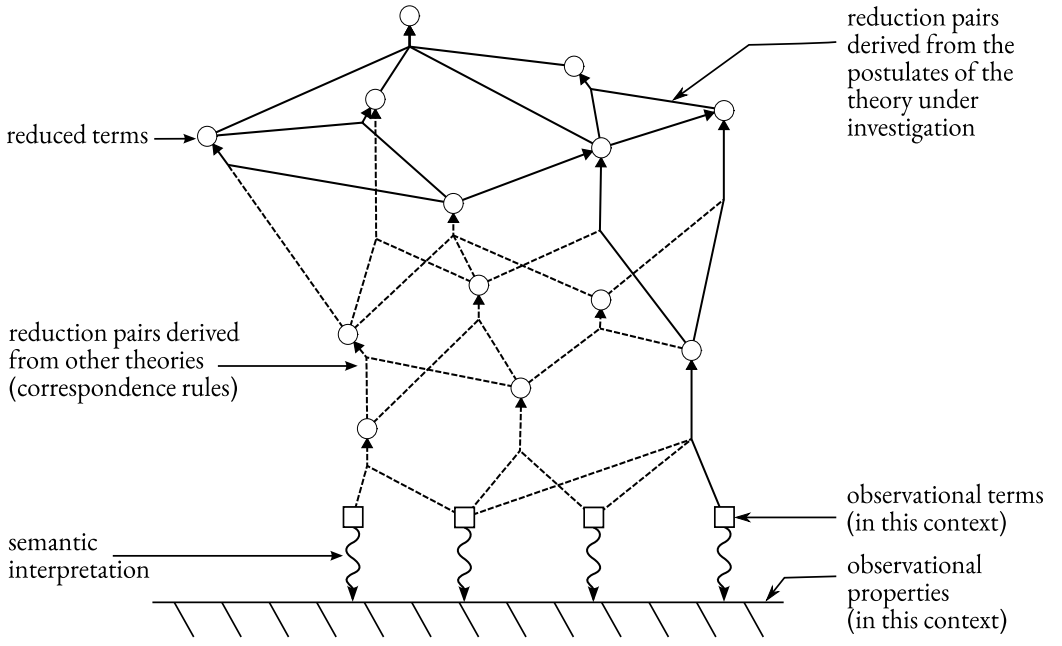


**Figure 3:** Feigl's diagram adapted to Carnap's first method of interpreting theoretical terms for one specific choice of the observational sublanguage. The merging arrows point from reducing to reduced terms.

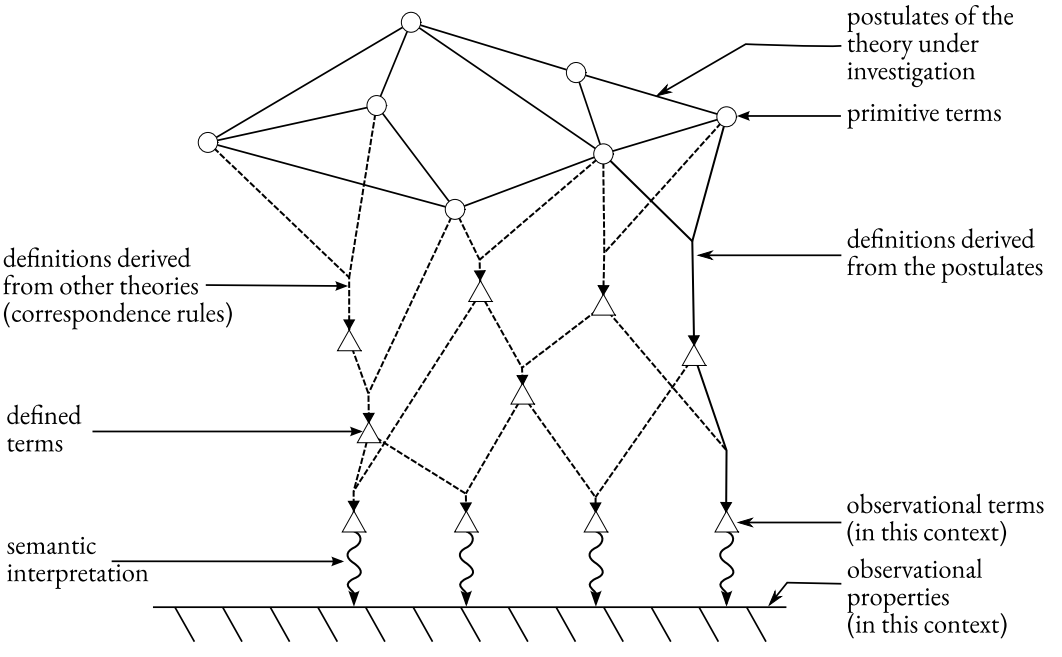


**Figure 4:** Feigl's diagram adapted to Carnap's second method of interpreting theoretical terms for one specific choice of the observational sublanguage. The merging arrows point from terms of the definiens to the definienda.

In later papers, Carnap ignores the first method (as does Feigl in his diagram), probably because he has come to the conclusion that the theoretical terms of science cannot be reduced to observational terms (Carnap 1956, 53). Carnap (1956, 49) also allows for probabilistic correspondence rules, echoing Reichenbach (Padovani 2015, 5). Probabilistic connections can be conditional on either more theoretical terms or more observational ones.

A curious wrinkle in the development of correspondence rules in the Received View is that although Carnap expressly moves from the explicit definability of theoretical terms to, eventually, the explicit definability of observational terms, his discussions of the relation of theoretical sentences and observational sentences, from his very first publication on the Received View (Carnap 1923) to the last (Carnap 1974), entail that observational terms can be explicitly defined in theoretical terms, but not vice versa (Lutz 2021, §15.5.1).

Carnap's concrete suggestions for correspondence rules stay essentially constant over time as well (Lutz 2021, §§15.5.2–3): He explicitly defines observable space-time regions as regions of a mathematical space, and defines physical properties of space-time regions as value ranges of fields over the mathematical space. The physical properties can then be used for defining phenomenal qualities.

## Conceptualizations Assuming the Received View

In providing a framework for the formalization of scientific theories, the Received View helps in the formalization of not only specific theories, but also other concepts of science. Some central ones are discussed in the following.

**Explanation.** Feigl (1929, 5-6, 11, 13, 111), possibly taking his position from Carnap (Carus and Friedman 2019, n. 24), and Carnap (1931, 98–99) declare that explanations are logical deductions from general laws, and Carnap (1939, §15) adds that they are structurally the same as predictions. This position is developed in much depth by Hempel (1942, §2.1), who adds that sufficient high probability can replace logical deducibility (§5.3), and by Hempel and Oppenheim (1948). The position assumes the syntactic view, for the simple reason that explanans and explanandum are assumed to be sentences in the language of a logic (although this is less clear for probabilistic explanations). Both Hempel (1965, §§2-3) and Carnap (1974, 7, 17–18) keep these views throughout their careers.

**Confirmation.** Probably the most famous account of confirmation that can be based on the syntactic view is the "prediction criterion of confirmation" (Hempel 1945, §7), better known as the hypothetico-deductive account of confirmation. Here, a true observation sentence that is deducible from (and thus explained by) a theory confirms it, and a so deducible false sentence disconfirms it. Hempel (1966, §2.2) presented this account in a popular textbook, but had also developed the competing "satisfaction criterion of confirmation" (Hempel 1943; see also Hempel 1945, §9). Here, *very* roughly, a theory $T$ formulated in first-order logic is directly confirmed by a sentence $E$ without quantifiers if and only if $E$ entails the logically strongest sentence that is entailed by the conjunction of $T$ and the sentence that the constant symbols that occur nontrivially in $E$ name all objects there are. $T$ is confirmed if and only if it is entailed by a set of sentences that are themselves directly confirmed by $E$, and disconfirmed if and only if its negation is confirmed. Carnap (1950) instead explicates confirmation using probability theory (see also Carnap 1963b, §V, Carnap 1974, 32–36, and ch. 29 in this volume).

**Reduction.** Relying only on the syntactic view, Nagel (1951, 330) suggests two individually necessary and jointly sufficient conditions for a reduction of a "secondary" discipline to a "primary" discipline: According to the "condition of definability", every term of the secondary discipline must be explicitly definable in terms of the primary discipline, where the definitions may be entailed by well-established empirical laws.[3] According to the "condition of derivability", every well-established statement in the secondary discipline must be logically derivable from well-established statements in the primary discipline (and presumably the explicit definitions demanded in the condition of definability). Nagel (1961, 355, n. 5) later jettisons the condition of definability, allowing instead for any sentences ("bridge principles") needed to meet the condition of derivability. In response to Nagel, Kemeny and Oppenheim (1952) develop an account of reduction that, in effect, restricts the condition of derivability to observation sentences, and thus relies on the syntactic view and the dual-level conception of language.

**Criteria of Cognitive Significance.** The different criteria of cognitive significance assume semantic empiricism and, to the extent that they rely on the syntactic view, also

[3] There is a bit of interpretation of Nagel in this summary. Van Riel (2011) describes the subtleties of Nagel's different positions and our understanding of them.

the dual-level conception of language. There are two fundamentally different approaches to developing such criteria. One class of approaches tends to define that a sentence is cognitively significant if and only if it entails or is entailed by an observation sentence, or assigns a probability to an observation sentence (e.g. Carnap 1928b, 327), although sometimes complete translatability is required (Carnap 1928a, §176). The other class of approaches defines that a *term* is cognitively significant if and only if it is definable (§38), related by a reduction sentence (Carnap 1936a), or related in some more complicated way (Carnap 1956, §VI) to observation terms (for overviews, see Hempel 1950; Reichenbach 1951; Lutz 2017).

**The Analytic–Synthetic Distinction.** Relying on the syntactic view, the dual-level conception of language, and semantic empiricism, Carnap (1958) defines the analytic and synthetic components of the conjunction $TC$ of the theory's postulates $T$ and the correspondence rules $C$ (see also Carnap 1963b, §24.D; 1974, ch. 28): Assuming a logically extended observation language, Carnap defines the synthetic component of $TC$ as its Ramsey sentence, which existentially generalizes on all of $TC$'s theoretical terms and entails the same observational sentences as $TC$ itself. Carnap defines the analytic component of $TC$ as the material conditional that has $TC$'s Ramsey sentence as its antecedent and $TC$ itself as its consequent (this is now usually called $TC$'s 'Carnap sentence'). Carnap notes that the analytic component entails only logically true observation sentences, the synthetic component contains no theoretical terms and entails the same observation sentence as $TC$ itself, and the conjunction of the analytic and the synthetic component of $TC$ is equivalent to $TC$ itself. These features he considers sufficient for establishing that the two definitions are adequate.

Two historically particularly interesting features of the Carnap sentence follow directly from its logical structure: Since the theoretical terms occur only in its consequent, their interpretation is only restricted (they are only given meaning) if the antecedent, the Ramsey sentence, is true. Therefore the meaning of a theoretical term relies on all observational sentences entailed by the theory, leading to a kind of meaning holism. And two observationally incompatible theories cannot both give meaning to their respective theoretical terms, leading to a kind of meaning incommensurability.

**Concept Formation.** Although a single reconstruction of a theory in the Received

View was not meant to describe a theory's development over time, the Received View allows for analyzing the relation between reconstructions of successive stages in the development of a theory and of concepts in particular. For instance, Carnap (1926, 35–36) describes how temperature can be introduced as proportional to the length of a mercury column. Although the concept of length based on rigid bodies involves a correction factor for thermal expansion, circularity can be avoided by determining the initial concept of length without a correction factor, use it for determining the concept of temperature, use this concept in turn for determining a refined concept of length, etc. Hempel (1952, 739, n. 77) refers to the similar "method of successive approximations" described by Victor F. Lenzen and argues that in general, concept formation is guided by the systematic import of the developed concepts (697–98). Reichenbach also assumes a modification of scientific concepts on the basis of empirical results (Padovani 2015, 5).

Elsewhere, Carnap (1936a, 445–46) describes how the meaning of a theoretical term that is related to observational terms by a reduction pair can be extended by introducing the convention that specific laws in which the theoretical term occurs also hold in an extension of the domain (see also Hempel 1952, 723–24).

## Images of the Received View

In a famous criticism of the Received View, Putnam (1962, 241) claims that "the double distinction (observation terms – theoretical terms, observation statements – theoretical statements) [is] completely broken-backed" because "the dichotomy under discussion was intended as an explicative and not merely a stipulative one", but:

1 (A) If an 'observation term' is one that cannot apply to an unobservable, then there are no observation terms.

2 (B) Many terms that refer primarily to what Carnap would class as 'unobservables' are not theoretical terms; and at least some theoretical terms refer primarily to observables.

3 (C) Observational reports can and frequently do contain theoretical terms.

4 (D) A scientific theory, properly so-called, may refer only to observables.

However, in an explication the explicans can deviate substantially from the explicandum

(Lutz 2012, §5.1) and the dichotomy probably was not meant as an explication anyway, since the observational terms did not have to correspond to terms in ordinary language and did not have to refer to perceptual properties. So it turns out that Putnam's four criticisms are, in his own terms, completely broken-backed. And as can be seen from the preceding discussion, each criticism individually relies on a misunderstanding of the Received View.

In his later turn against the Received View, Hempel (1969) repeats many of Putnam's criticisms and misrepresentations, and adds the mistaken assumption that correspondence rules in the Received View have to be analytic. For this to be so, they would have to be equivalent to $TC$'s Carnap sentence, but this is neither demanded in the Received View nor plausible. In general, Hempel's influential disavowal of the Received View rests to a large extent on criticisms of a straw man as well (Lutz forthcoming).

Many critics who followed Putnam and Hempel similarly rely for their criticisms on misrepresentations, assuming for example that the Received View requires exhaustive axiomatizations in first order logic, dismisses scientific models, is meant to make the term 'theory' more precise, rather than provide a framework for explicating theories (Lutz 2012), or that the Received View does not allow for axiomatizations in naive set theory (Stegmüller 1976, 30–31, 34, 36–37). Some of these misrepresentations unfortunately have their origins in declarations of logical empiricists, like Feigl's skewed diagram on the interpretation of theories and many of Hempel's later claims about the Received View. This is similar to misrepresentations of logical empiricism in general (Verhaegh 2024).

Without misrepresentations, however, the Received View is a flexible framework for the reconstruction of scientific theories, with some successes in the analysis of specific theories and concepts relevant in science. This includes concepts of avowed opponents of logical empiricism. For instance, a meaning holism similar to that espoused by Quine (1951, 38) and an incommensurability of theoretical terms similar to that defended by Feyerabend (1962, 58–59) follow from the features of the Carnap sentence. And thanks to the somewhat modular nature of the Received View's central assumptions, even critics of the Received View as a whole may be able to make use of some of its results.

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